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PRESS BULLETIN NO. 32.

CULTURAL METHODS FOR CONTROLLING THE COTTON BOLL WORM.

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It is a matter of record that cotton culture has been attempted in Hawaii upon several different occasions, but there can be no doubt but what the attempt that has been made in the last few years has been the largest and most systematic of any attempts made. It seems to be that the profitableness of cotton culture is going to depend largely upon the success that is obtained in controlling insect pests. Cut worms, aphis, mealy bugs and others at times cause considerable damage to the cotton plants, but the one pest that does more damage than all others combined is the small boll worm (*Gelechia gossypiella*). In fields where the worm has been undisturbed, as high as 60 to 75 per cent of the bolls have been infested by this boll worm, in which case the cotton that may be picked from the field will not be sufficient to pay any profit on the labor involved in producing the crop.

In Bulletin No. 18 of this Station a detailed description of the insect has been given and from this we take the life history which is as follows:

The eggs are deposited singly upon squares, flowers or leaves—from which in about ten days the larva or worm is hatched. The larva feeds upon the plant for a period of about twenty-three days, after which it pupates and emerges from the pupa as an adult or moth fourteen days later. After a few days the moth will begin egg-laying and lives for several days. The larva is the form that does the damage to the cotton. It may attack the squares or flowers and destroy the vital parts of the flower, in which case the square or bloom falls to the ground. Scores of squares from each plant in our Caravonica field fell to the ground during the month of April as a result of insect attack. The larva also attacks the young bolls in all stages of growth and usually damages the lint and eats out the seed contents and causes a premature opening of the boll.

It has been our observation that Sea Island cotton is more subject to the attack of this worm than Caravonica and Egyptian somewhat less subject, while upland cotton is the least subject of all varieties to their attack. The worm is known to attack other host plants and has been found in Milo (*Thespesia populnea*), may possibly be found in Hau bushes and in India it is said to attack trees which have oil-bearing seeds.

Because of its occurrence in large numbers only upon cotton it will be possible in a measure to control it by cultural methods, and, until an effective parasite is found, we must make the best use possible of such methods. It must be remembered that these additional measures add to the expense of cotton production and so long as effective should be as simple as possible. However, the pruning advocated being necessary for other reasons, only the two others given should be considered extra.

Cultural methods include, first, annual pruning; second, clean culture; third, trapping the mature moths.

PRUNING.

By severely pruning the plants in the fall and burning all branches and bolls immediately, large numbers of the insect in different stages will be destroyed. If no other host plant offers itself most of the insects that survive the fire stand great chance of perishing before new food in the shape of squares, flowers and bolls of cotton will be found in the following spring. It is important that this work should be done in as short a time and in as thorough a manner as possible when once started and that all plants in the vicinity should be pruned. Ornamental plants in yards, or hedges of cotton remaining, or any plants left in the field, serve as breeding places for the insect in which they are carried over for the next crop. This we learned to our sorrow in carrying on a pruning experiment to determine at what time it was best to prune. To secure best results in burning the green branches, a good hot fire should be started with dry material and the work of piling on the brush will be greatly facilitated if the fire is placed in a shallow hole or gulch near the cotton field. In clearing land of guava or other bushes it would be well to leave a part of these in the place where it is intended to burn the cotton prunings.

Cotton Plant Properly Pruned.

Concerning pruning there is much yet to be learned, whether it shall be done early or late, high or low, and for how many years the plant will thrive under such treatment. All that we know is that it is necessary to prune occasionally in order to control the size and shape of the plants and to maintain the quality of the lint. From experiments in 1911 we conclude that with us fall pruning is imperative in order to allow proper development of the plant during the winter months when moisture is plentiful. Plants allowed to bear during this time, then pruned about March first, made plants only about two-thirds as large as those pruned December first. The increase in yield of fall pruned plants was nearly 46 per cent, the average yield per plant being 1.2 pounds and .82 pounds of lint per tree for fall and spring prunings during the second year's growth of the plants.

PERCENTAGE OF BOLL WORM INFESTATION, 1911.

Caravonica 1-2 Acre		Caravonica 1-2 Acre		Sea Island 1 acre—new seeding.	
Date of Picking	Cut back Dec. 5, 1910	Date of Picking.	Cut back Mar. 1, 1911	Date of picking.	
May 31	70.6			Aug. 22*	3.9
June 9	49.5	Jan. 18	19.	" 29	7.9
" 17	26.	" 30	16.1	" 29	8.0
" 24	39.9	Feb. 8	23.6	Sept. 2	21.3
July 5	14.9	" 26	19.5	" 5	23.
" 12	9.8			" 14†	3.9
" 20	11.1			" 18	12.
" 26	7.3			" 20	16.
Aug. 2	9.5			" 20	12.4
" 11	3.1	Aug. 11	3.5	Oct. 7	15.2
" 17	4.2	" 17	3.5	" 12§	6.9
" 26	9.2	" 26	3.7	" 16	13.6
" 31	5.0	Sept. 1	3.8	" 18	13.5
Sept. 8	6.	" 9	2.6	" 26	17.7
" 16	2.9	" 17	2.1	Nov. 1	20.9
" 22	2.	" 23	4.9		
" 28	5.1	" 30	2.7		
Oct. 10	4.3	Oct. 10	1.7		
" 20	5.	" 20	6.5		

* First Picking. † Second. § Third.

From this it will be seen that fall pruning is unquestionably preferable. We have no conclusive ideas as to whether to prune high or low, the high pruning in some cases excelling while in other cases the low pruned plants gave the better yields. One theory given is to prune very low at first and at each succeeding season prune a few inches higher so as always to cut on new growth. After several such treatments it may become necessary to prune low again. Another plan is to cut high and low alternately. However, the form of the individual plant and the conditions under which it is grown, rather than any book rule, will determine the treatment which that particular plant should have. In 1911 the yield from all high pruned plots (four feet high) slightly exceeded that from low pruned plots pruned two feet high. These results were from Caravonica cotton.

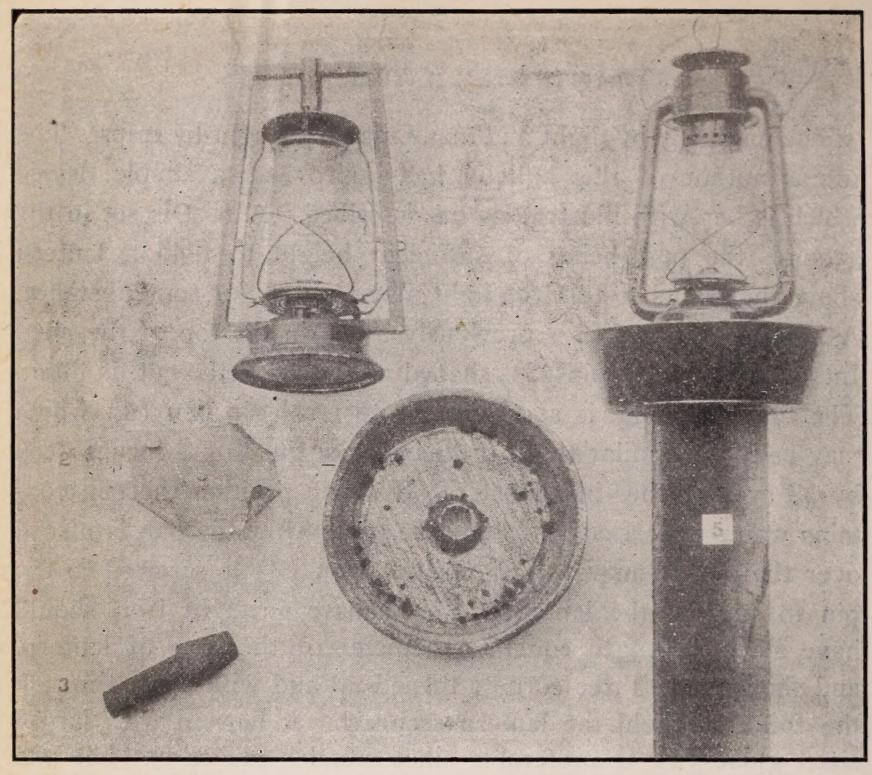
With Sea Island cotton our experience has been that growth starts low even upon high pruned plants so that low pruning becomes necessary. To control the size and shape of the plants the pruning of Caravonica becomes more necessary than for other varieties because of its rank growth, but in order to control the boll worm the pruning of all varieties becomes necessary.

CLEAN CULTURE.

This consists in picking up and burning fallen squares when known to contain the boll worm and, secondly, when picking the cotton the pickers should carry an extra sack in which the infested bolls should be put and carried to the side of the field and later burned. This part of the fight against the boll worm is in many cases very difficult to carry on since the laborers in the field look upon it as just so much extra and unnecessary work, but if any headway is to be made against the boll worm or if any profit from the crop is expected some means should be taken to get this work done by the cotton pickers. At the Station we have also fumigated the seed cotton at the gin house with hydrocyanic acid gas but some of the worms seem to have survived this treatment.

TRAPPING THE MATURE MOTHS.

The moths fly by night and many may be caught by traps. The junior author of this bulletin has improvised a simple device which is herewith illustrated and described. A post is set in the ground, the post being of sufficient height to hold a lantern above the plants so that the light may be seen for some distance. A hole 1 1-2x6 inches is previously bored in the top of the post. Into this a wooden pin (3), shaped as shown in the cut, is fitted. The top of the pin is so shaped as to receive a pan (4) which may be made similar to an ordinary cake tin 2 or 3 inches deep by 12 or 14 inches in diameter. When in position the pan contains water with a coat of kerosene oil. After the pan is placed over the pin a square piece of sheet iron (2) is screwed to the pin to support the lantern. This square sheet of iron should have sides of length equal to diameter of the base of lantern, and should have three corners turned up and with a pin through the fourth to hold the lantern securely. A lantern with larger sized globe (1) is preferable since smaller globes get hot and then break should there come a dash of rain. The trap as put together and set up in the field is shown in the cut (5). The moths fly towards this light and many of them fall into the pan and are destroyed. Many more will be caught upon still nights than upon windy nights. Where winds are prevalent, place trap toward the leeward side of the field and where winds are not prevalent, traps can be placed at equal intervals from each other or in the center of small fields. Two, three or even one such trap per acre will give good results. When one considers the great egg-laying capacity of a single moth it is hard to overestimate the value of capturing 10 to 50 or more moths a night, possibly per acre, if they are plentiful. By pruning partly in December and partly in March we commenced the picking season of 1911 with 70 per cent of bolls infested as shown in the accompanying table, and then by fighting the insect according to the methods given above we succeeded in controlling the situation somewhat and in reducing the percentage of infestation as also shown in the table.



Lantern Trap and Its Parts

Of course the percent of infested bolls in the early pickings is larger than the percent of the total number of bolls, since the worm caused so many of the bolls to open prematurely. The table also shows the greater liability to attack of the Sea Island variety. During the season of 1912 we aim to get the benefit of the annual pruning as described by doing the work all at one time; in which case we hope to have an easier fight than in 1911; yet because of more or less ornamental cotton and milo in Honolulu we can hardly hope to start clean. Upon one large planting where the pruning and burning was well done in 1910,—we are informed that the infestation in the spring of 1911 was very light; but, because of the difficulty to get the pickers to collect infested bolls, the percentage of infestation greatly increased during the season. This shows what can be accomplished by employing the first named method and we have demonstrated the value of the second and third. Other host plants than cotton must always be kept in mind and cut down and burned; then if the grower works faithfully along the lines mentioned above he may hope for some returns for his labors.